CLAIMS

We claim:

1. An X-ray imaging device for imaging a sample, wherein the sample is within an X-ray shielded volume comprising:
   a) an X-ray source capable of emitting an X-ray beam within a beam path to illuminate the sample;
   b) a source beam shield connected to the X-ray source;
   c) an X-ray detector connected to an exit shield shielding an X-ray beam emerging from the sample;
   d) a first volume shield defining an elongated generally convex receptacle for receiving a first portion of the sample, and having therein a transverse elongated shielding portion slidably coupled to said source beam shield; and
   e) a second volume shield defining an elongated generally convex receptacle for receiving a second portion of the sample, and having therein a transverse elongated shielding portion slidably coupled to said exit shield;

   whereby the sample may extend beyond the first and second volume shields, and whereby these shields may be brought into contacting opposition to provide an x-ray shielded volume containing at least a portion of the sample, the emitted x-ray beam and the emerging x-ray beam.
2. The device of claim 1 wherein said emission from the device is below a regulatory level is at or below 0.5 milliroentgen per hour at any point 5 centimeters outside an external surface of said X-ray imaging device.
3. The device of claim 2 wherein:
   a) the sample rotates relative to the X-ray shielded volume.
4. The device of claim 2 further comprising:
   a) means for rotating the sample relative to the X-ray shielded volume.
5. The device of claim 4 further comprising:
   a) means for translating the sample relative to the X-ray shielded volume.
6. The device of claim 3 wherein:
   a) the sample translates relative to the X-ray shielded volume.

7. The device of claim 2 further comprising:
   a) a shielded telescoping X-ray source shield permitting elongation of said beam path.

8. An imaging device comprising:
   a) a source of ionizing radiation;
   b) a detector of ionizing radiation; and
   c) a means for shielding an object to be irradiated by said source of ionizing radiation so as to form an image detected by said detector of ionizing radiation;
   wherein said means for shielding limits external exposure of ionizing radiation produced by said source of ionizing radiation to a level at or below 0.5 milliroentgen per hour at any point 5 centimeters outside an external surface of said imaging device; and wherein said means for shielding has a mass of less than 200 kg.
9. The imaging device of claim 8 wherein said means for shielding has a mass of less than 14 kg.
10. The imaging device of claim 8 wherein said means for shielding has a mass of less than 10 kg.
11. The imaging device of claim 8 wherein said means for shielding has a mass of less than 8 kg.
12. The imaging device of claim 8 wherein said means for shielding is disposed between said source of ionizing radiation and said detector of ionizing radiation.
13. The imaging device of claim 8 wherein said ionizing radiation is an X-ray.
14. The imaging device of claim 13 wherein said X-ray has an energy selected from the group comprising: 10-130 kV, 20-130 kV, and 70-80 kV.
15. The imaging device of claim 13 wherein said X-ray has a wavelength between about 10^{-5} to 10^{3} Å .
16. The imaging device of claim 13 wherein said X-ray has a wavelength between about $(10^{-5} - 10^{3}) \times 10^{-10}$ meters.

17. An X-ray imaging device for imaging a sample contained within an X-ray shielded volume comprising:

a) an X-ray source;

b) an X-ray imaging detector comprising:

i) an X-ray image intensifier, and

ii) an image detector that detects the output of said X-ray image intensifier; and

c) an X-ray shielded volume comprising:

i) a core volume shielded by a left volume shield and a right volume shield separably connected so as to permit insertion and removal of a sample, said core volume having a top opening and a bottom opening,

ii) a beam path emitted from said X-ray source within a beam path volume,

iii) a shielded telescoping sleeve permitting elongation of said beam path volume,

iv) said beam path volume intersecting said core volume;

v) wherein said X-ray source is located at one end of said beam path, and said X-ray imaging detector is located at another end of said beam path so as to image an object placed in said beam path; and

d) wherein said X-ray source is shielded from external radiation by said X-ray shielded volume.

18. The device of claim 17 wherein:

a) the sample rotates relative to the core volume.

19. The device of claim 17 wherein:

a) the sample translates relative to the core volume moving in the top opening and the bottom opening.

20. The device of claim 17 wherein:

a) the sample rotates relative to the core volume, and

b) the sample translates relative to the core volume moving in the top opening and the bottom opening.

21. The device of claim 17 wherein X-ray emissions are at or below 0.5 milliroentgen per hour at any point 5 centimeters outside an external surface of said X-ray imaging device.

22. The device of claim 17 wherein the mass of said X-ray shielded volume is less than 14 kg.

23. The device of claim 17 wherein the mass of said X-ray shielded volume is less than 10 kg.
24. The device of claim 17 wherein the mass of said X-ray shielded volume is less than 8 kg.
25. The device of claim 17 wherein the mass of said X-ray shielded volume is less than 5 kg.
26. The device of claim 17 wherein said X-ray shielded volume X-ray shields at said top and bottom openings.
27. The device of claim 26 wherein said X-ray shielded volume further comprises a rotatable stage within said X-ray shielded volume for controlled rotation of said sample.

28. A portable imaging device for imaging a sample contained within a shielded volume comprising:
    a) a penetrative photon source;
    b) a penetrative photon imaging detector comprising:
        i) a penetrative photon image intensifier, and
        ii) an penetrative photon image detector that detects the output of said penetrative photon image intensifier; and
    c) an penetrative photon shielded volume comprising:
        i) a core volume shielded by a left volume shield and a right volume shield separably connected so as to permit insertion and removal of a sample, said core volume having a top opening and a bottom opening,
        ii) a penetrative photon beam path emitted within a beam path volume,
        iii) a shielded telescoping sleeve permitting elongation of said beam path volume,
        iv) said beam path volume intersecting said core volume;
        v) wherein said penetrative photon source is located at one end of said beam path, and said penetrative photon imaging detector is located at another end of said beam path so as to image an object placed in said beam path; and
    d) wherein said penetrative photon source is substantially shielded from external radiation by said penetrative photon shielded volume.

29. A portable imaging device for imaging a sample contained within a shielded volume comprising:
    a) means for generating penetrative photons for imaging a sample;
    b) means for detecting penetrative photons transmitted through said sample and creating an image; and
    c) means for shielding said penetrative photons to a level below 0.5 milliroentgen per hour at any point 5 centimeters outside an external surface of said portable imaging device.
30. The portable imaging device of claim 29 further comprising:
    a) means for telescoping said generating means closer and further away from said detecting means.
31. The portable imaging device of claim 29 further comprising:
    a) means for mechanically protecting personnel from movements of said portable imaging device.
32. The portable imaging device of claim 29 further comprising:
    a) means for translating and rotating said sample relative to said portable imaging device.
33. A method for using the portable imaging device of claim 29 to image said sample inserted within said portable imaging device, the method comprising:
    a) imaging a first segment of said sample using said penetrative photons to create images;
    b) rotating said sample to create multiple images;
    c) assembling a first three dimensional representation of said sample first segment;
    d) translating said sample to a next segment to create a next three dimensional representation; and
    e) repeating the above steps until some or all of the sample has been imaged.